Claims

What is claimed is

1. A method of identifying a defect in a semiconductor wafer, the method comprising:

applying heat to a conductive structure formed on said semiconductor wafer;

measuring a signal indicative of temperature of a portion of the conductive structure heated by conduction of the applied heat therethrough, thereby to obtain a measurement;

repeating the act of measuring at each of a number of different locations on the conductive structure, thereby to obtain a plurality of measurements; and

determining presence of the defect in the conductive structure, depending on the plurality of measurements.

2. The method of Claim 1, wherein:

a laser beam is used during said applying of heat;

reflection of another laser beam is measured during said measuring; and

the laser beams are scanned together during said measuring.

3. The method of Claim 2, wherein:

the laser beams are coincident, thereby to form a single spot on the conductive structure.

4. The method of Claim 1, wherein:

the conductive structure has at least one dimension less than 1 μm.

5. The method of Claim 1, wherein:

an electron beam is used during said applying of heat.

6. The method of Claim 1, wherein:
a thermal imager is used during said measuring.

7. The method of Claim 1, wherein:
said conductive structure is periodic in space along a direction, and said locations are along said direction.

8. The method of Claim 7, wherein:
said determining includes using a transform of said plurality of measurements, said transform converting said plurality of measurements from a spatial domain into a frequency domain.

9. The method of Claim 7, wherein:
said determining includes identifying a frequency component not found in a corresponding plurality of measurements from a reference wafer.

10. The method of Claim 7, wherein:
said determining includes comparing a curve defined by said plurality of measurements to a reference curve defined by a corresponding plurality of measurements from a reference wafer.

11. The method of Claim 7, wherein:
said determining includes comparing a curve defined by said plurality of measurements to a baseline.

12. The method of Claim 7, wherein:
a measurement is performed at least at a plurality of vias located sequentially one after another in said direction.

13. The method of Claim 7, wherein:

a pump beam is incident on a first trace in the conductive structure during said applying; and

a probe beam is incident on a second trace in said conductive structure during said measuring; and

wherein said first trace is coupled to said second trace through at least one via.

14. The method of Claim 11 wherein:

each of said first trace and said second trace are in a single metal layer.

15. The method of Claim 11, wherein:

each of said first trace and said second trace are in different metal layers.

16. The method of Claim 1, wherein:

said determining includes comparing the plurality of measurements to a corresponding plurality of measurements obtained from a reference wafer.

17. The method of Claim 1, wherein:

said repeated acts of measuring are performed while moving a stage carrying the semiconductor wafer containing the conductive structure; and

performing said measuring continuously, thereby to obtain an analog signal; and

using said analog signal during said determining.

18. A method for determining the quality of a conductive structure, the method comprising:

applying heat to the conductive structure using a modulated heat source;

measuring a phase difference between temperature change of said conductive structure and modulation of said heat source; and

analyzing said phase difference to determine quality of said conductive structure.

19. The method of Claim 18 wherein reflection of a laser beam is used to measure the phase difference.

20. The method of claim 18 wherein said quality is related to a defect in said conductive structure.

21. The method of Claim 20 wherein said defect is any defect in a group consisting of voiding, narrow trace, and misalignment of a via to a trace.

22. A method for determining the quality of a conductive structure, the method comprising:

applying heat to the conductive structure using a modulated heat source;

varying the frequency of modulation of said heat source;

measuring a change in temperature of said conductive structure, as a function of the frequency of modulation; and

analyzing said function to determine the quality of said conductive structure.

23. The method of Claim 22, wherein reflection of a laser beam is used to measure the temperature change.

24. The method of Claim 22, wherein heat is applied to said conductive structure using a laser beam.

25. The method of Claim 22 further comprising:

repeating the act of measuring at each of a number of different locations on the conductive structure, thereby to obtain a plurality of measurements; and

using said plurality of measurements during said analyzing.

26. The method of Claim 22 further comprising:

moving a stage carrying a semiconductor wafer containing the conductive structure at a fixed speed; and

performing said act of measuring continuously, thereby to obtain an analog signal; and

using said analog signal during said analyzing.

27. The method of Claim 22 wherein said analyzing comprises:

identifying irregular features in the conductive structure.

28. An apparatus for identifying a defect in a conductive structure, the apparatus comprising:

a laser for applying heat to the conductive structure;

the sensor for measuring a signal indicative of temperature of a portion of the conductive structure heated by conduction of the applied heat therethrough; and

means for determining presence of the defect in the conductive structure, based on the measured temperature.

29. The apparatus of Claim 27, wherein said sensor for measuring comprises a thermal imager.

30 ~~29~~. The apparatus of Claim 27 wherein said means for determining comprises a personal computer.